FIG. **2** is a block diagram of an example system providing various modes in which to input textual content in a VR space.

FIGS. **3**A-**3**C illustrate examples of a user accessing a VR space to perform interactive tasks.

FIGS. **4**A-**4**B illustrate an example of showing a VR space in which to perform textual input activities.

FIG. **5** is a flow chart diagramming one embodiment of a process to predict a contact zone associated with an input provided in a VR space.

FIG. **6** shows an example of a computer device and a mobile computer device that can be used to implement the techniques described herein.

Like reference symbols in the various drawings indicate like elements.

DETAILED DESCRIPTION

The systems and methods described herein can receive user input in a VR space and from such input can detect particular headings, trajectories, and velocities for movements associated with the user input. In some implementations, the systems and methods can determine (e.g., predict) which motions a user intends to carry out in the VR space. For example, a user can input text on a virtual keyboard object using arcing movements associated with virtual drumsticks, mallets, controllers, or other virtual object or physical object tracked in the VR space.

In some implementations, the arcing (e.g., swinging) movements may include measurable speed and/or trajectories that can be used to predict a time of impact with a particular virtual object. The speed and/or trajectories can also be used to predict a location of impact on the virtual object. Such predictions can enable text entries on a keyboard virtual object to occur before virtual impact with the keyboard virtual object occurs in real time. This can provide an advantage of improved speed of text entries and early error correction of the text entries.

The movements can be performed by a user holding physical devices including, for example, drumsticks, controllers, mobile devices, or other object(s) configurable to select keys on a virtual keyboard). The movements can provide input to trigger tracking and prediction tasks to be carried out by the systems described herein. In some implementations, the tracking and prediction tasks can be used to determine which key or keys on the virtual keyboard object that the user intends to select (or collide with) using a tracked object (e.g., drumstick, controller, mobile device, sword, or other device configurable to select keys on a virtual keyboard). In some implementations, the tracked object may be a virtual object and the user may use physical hands (tracked in the VR space by sensors) to simulate movements of a virtual object that can be used to select portions of the virtual object (e.g., keys on a virtual keyboard).

In general, the systems and methods described in this disclosure can include movement tracking and prediction mechanisms to predict contact locations (e.g., collision zones) between two or more objects in a VR space. For example, a contact may occur upon a drumstick movement being tracked into a zone (defined in virtual space) that houses the virtual keyboard. The contact (i.e., collision) may occur as the drumstick selects the key. However, the movements can be analyzed before contact to determine which key or keys the user intends to collide with. In some implementations, the movements carried out by the user may pertain to user-generated input translated into the VR space.

In some implementations, a predicted collision can be based upon a context associated with the user. For example, if the user entering text on a virtual keyboard with, for example, drumsticks is in a text messaging application, the systems described herein can use automatic corrections associated with the user's typical text messaging habits. If instead, the user were to be entering text in a business email account, different dictionaries, automatic completion text, and automatic correction text may be employed.

In some implementations, a predicted collision can be based upon a context associated with the environment. For example, if the user is entering text while engaged in several applications in the VR space, the systems described herein may use an eye gaze position and/or head position to determine which application the user is targeting (e.g., intending) to enter text. The systems can then enter or not enter text into particular applications according to the context of eye or head position.

In operation, two or more objects that can be tracked to determine (e.g., predict) where and/or when a contact (e.g., collision) may occur between the objects. In some implementations, the two or more objects can include two controllers used as input devices and a virtual keyboard object to receive input from the two controllers. In some implementations, the objects can include a tracked arm (e.g., hand) and a virtual object that the arm can touch (e.g., collide into). In some implementations, the objects can include a mobile device, a drumstick or selection device, and/or a menu object. In some implementations, the objects can include legs (e.g., feet) and virtual objects placed in the VR space to receive input from foot movements.

The prediction of contact zones can provide an advantage of allowing users to comfortably enter text in unconventional ways. For example, the movement tracking and prediction mechanisms described herein can enable a user to input text on a virtual keyboard object using virtual drumsticks to select keys on a virtual keyboard object. The prediction mechanisms can be used to suppress particular contact with virtual objects or portions of such objects (e.g., keys on the keyboard) to provide a user experience of text entry that enables fast and accurate text and word formation, in response to user-based hand, arm, or finger motions. The suppression of particular contact can provide an advantage of allowing the user to enter data content without accidentally entering typos or menu selections outside of an intended collision point associated with a tracked object (e.g., hand, finger, controller, drumstick, etc.).

In addition, the tracking, translating, and suppression of particular movements can provide an advantage of normalizing text entry movements to provide textual output that is accurate for a user. The input may be provided via controller or hand movements that interact with unconventional text entry into one or more virtual devices. Examples of objects associated with unconventional text entry may include a keyboard shown as a musical instrument or a menu displayed in a stacked or fanned manner in the VR space.

In some implementations, a user may enter text using motion to input the text into an ergonomically modified virtual keyboard or other virtual object fashioned in a way to enter text, numbers, or symbols in the VR space. An ergonomically modified keyboard can be crafted onto a virtual object, representing a keyboard that allows for ergonomic interaction with the keyboard via controllers, hands, or extensions of such controllers or hands (e.g., drumsticks,